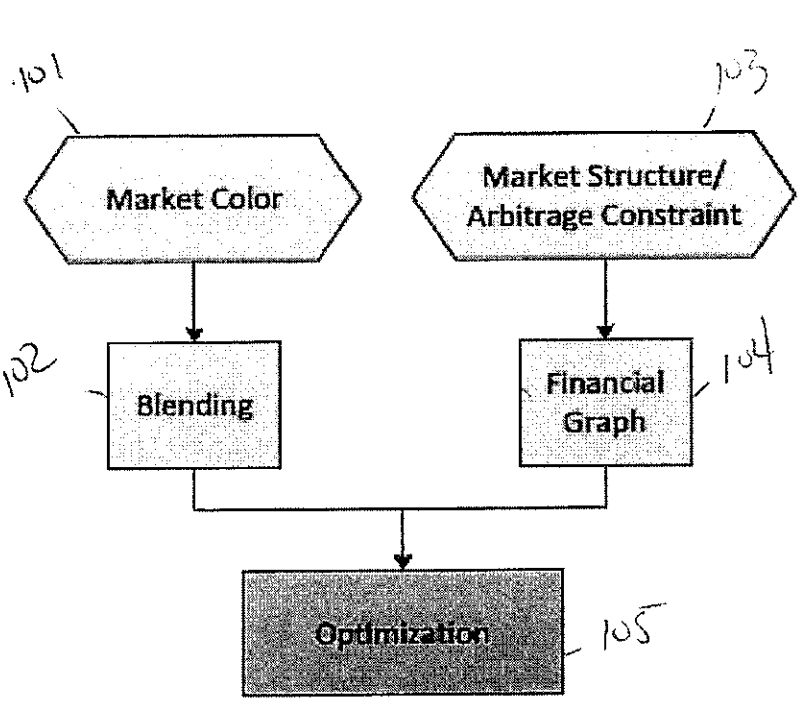

100
101
Market Color
103
Market Structure/
Arbitrage Constraint
102
Blending
104
Financial
Graph
Optimization
105

Fig. 1

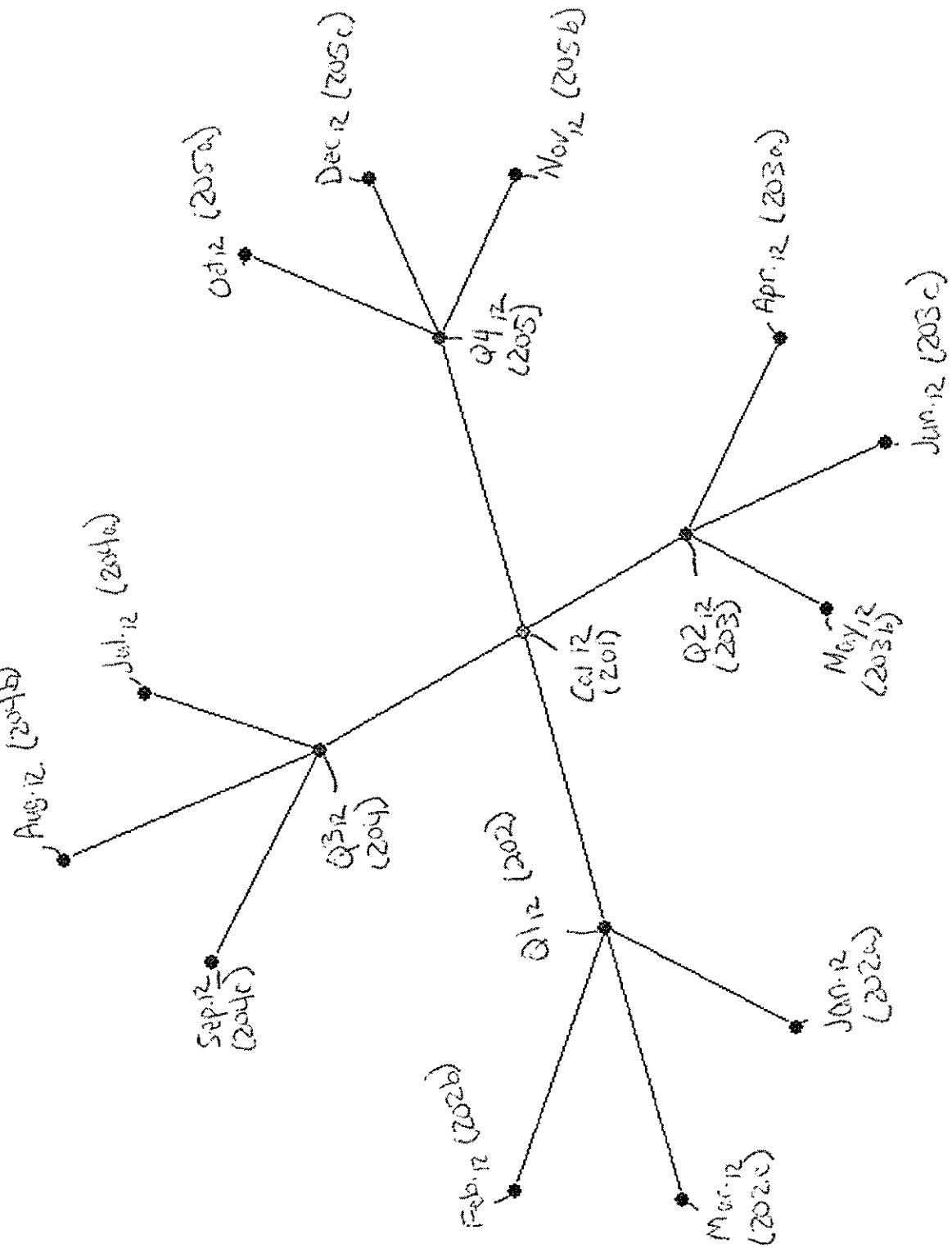

200
Aug. 12 (204b)
Jul. 12 (204a)
Sep. 12 (204c)
Q3 12 (204)
Q4 12 (205)
Oct 12 (205a)
Dec 12 (205c)
Nov 12 (205b)
Q1 12 (202)
Feb. 12 (202b)
Mar. 12 (202c)
Jan. 12 (202a)
Q2 12 (203)
Apr. 12 (203a)
May 12 (203b)
Jun. 12 (203c)
Cal 12 (201)

Fig. 2

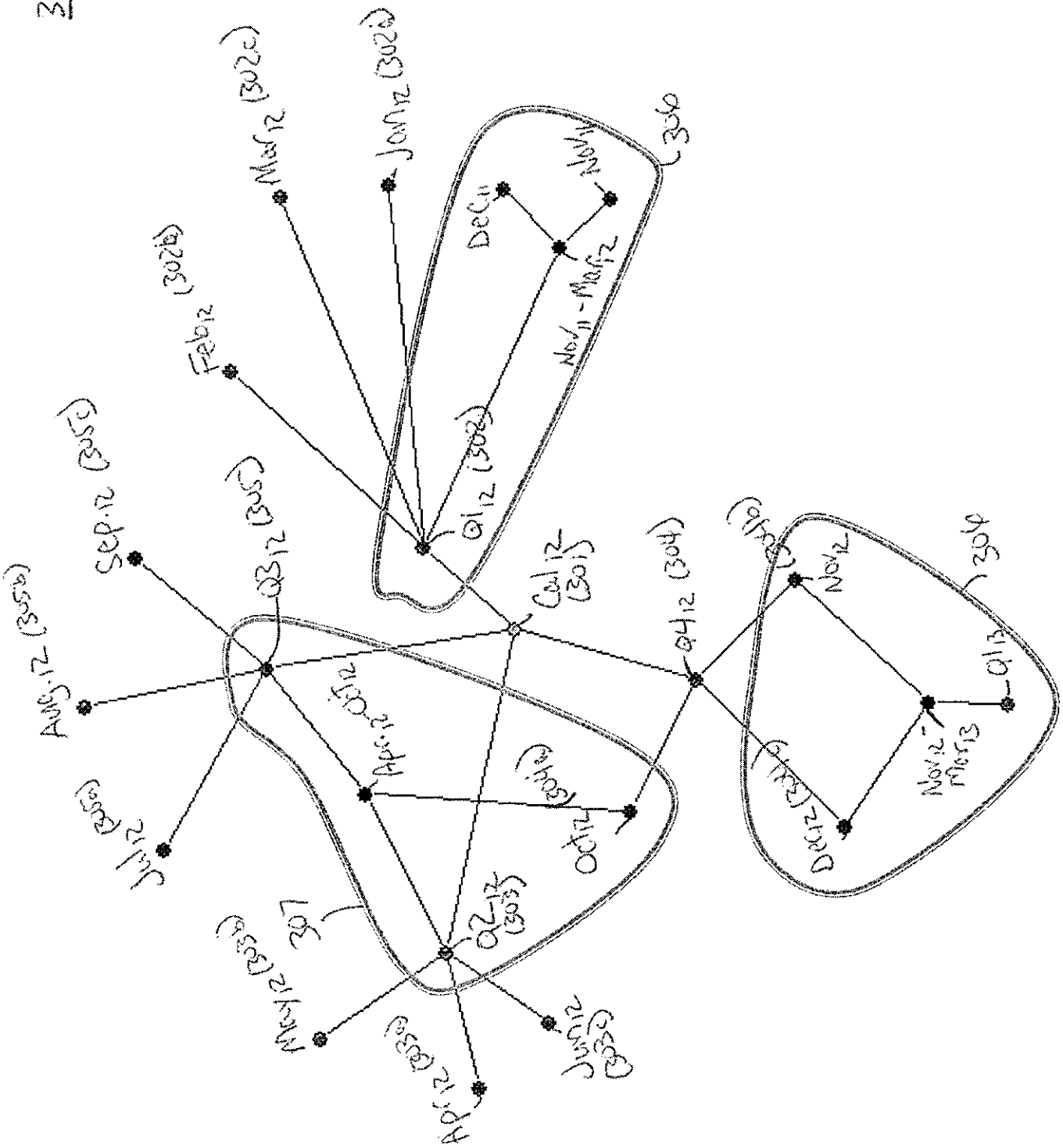

300
Aug.12 (305a)
Sep.12 (305c)
Feb12 (302b)
Mar12 (302c)
Jan12 (302a)
Jul12 (305a)
Q3 12 (305)
Q1 12 (302)
Dec11
Nov11 - Mar12
306
Q4 12 (304)
Oct12
Apr12
May12 (305a)
Q2-12 (303)
Jun12 (305a)
Apr12 (305a)
Aug12 (305a)
Nov12
Dec12 (305a)
Nov12 - Mar13
Q1 13
308

Fig. 3

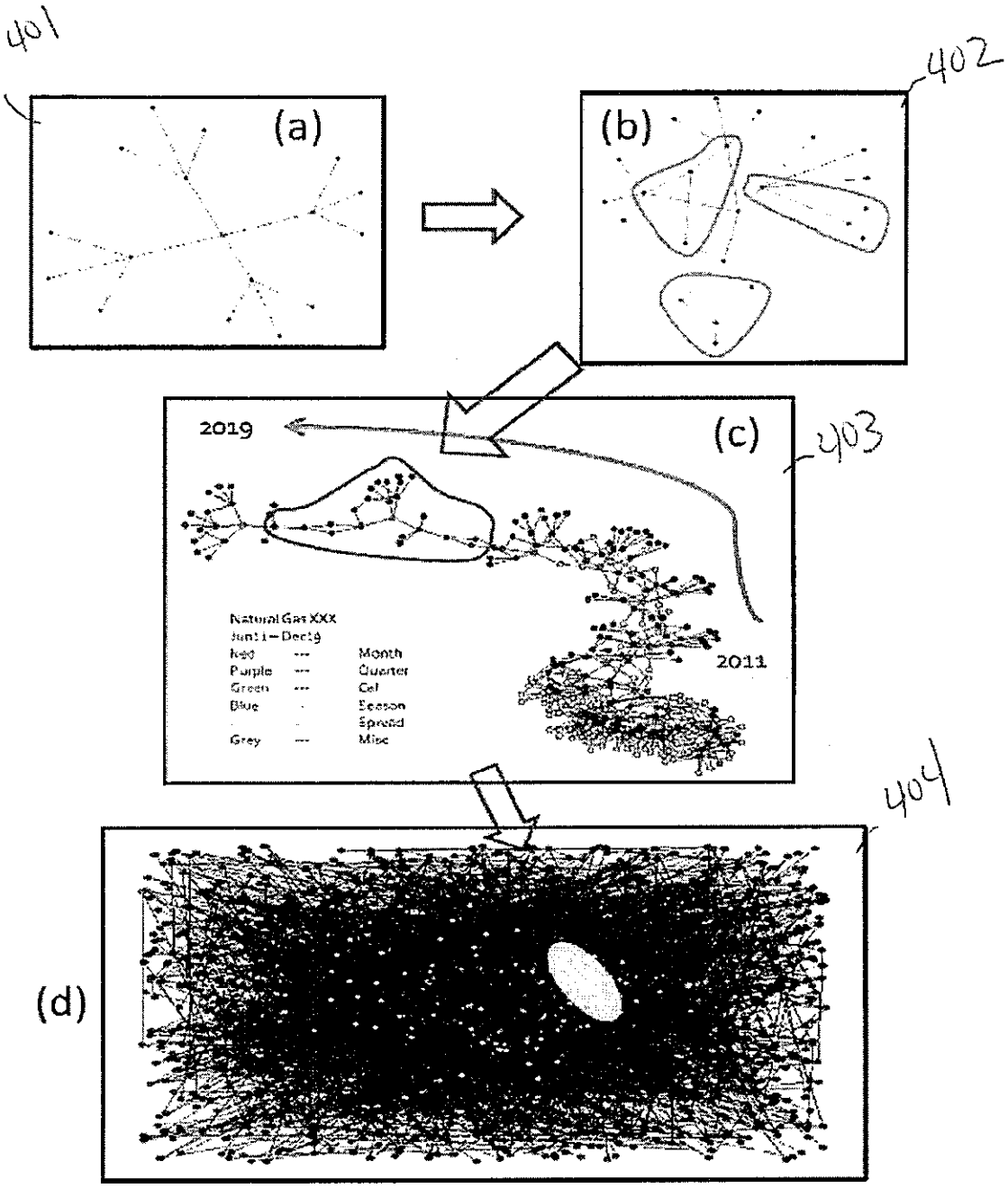

401
(a)
402
(b)
2019
(c)
403
2011
Natural Gas XXX
Jun 1 – Dec 19
Red --- Month
Purple --- Quarter
Green --- Cal
Blue - Season
- - Spread
Grey --- Misc
404
(d)

Fig. 4

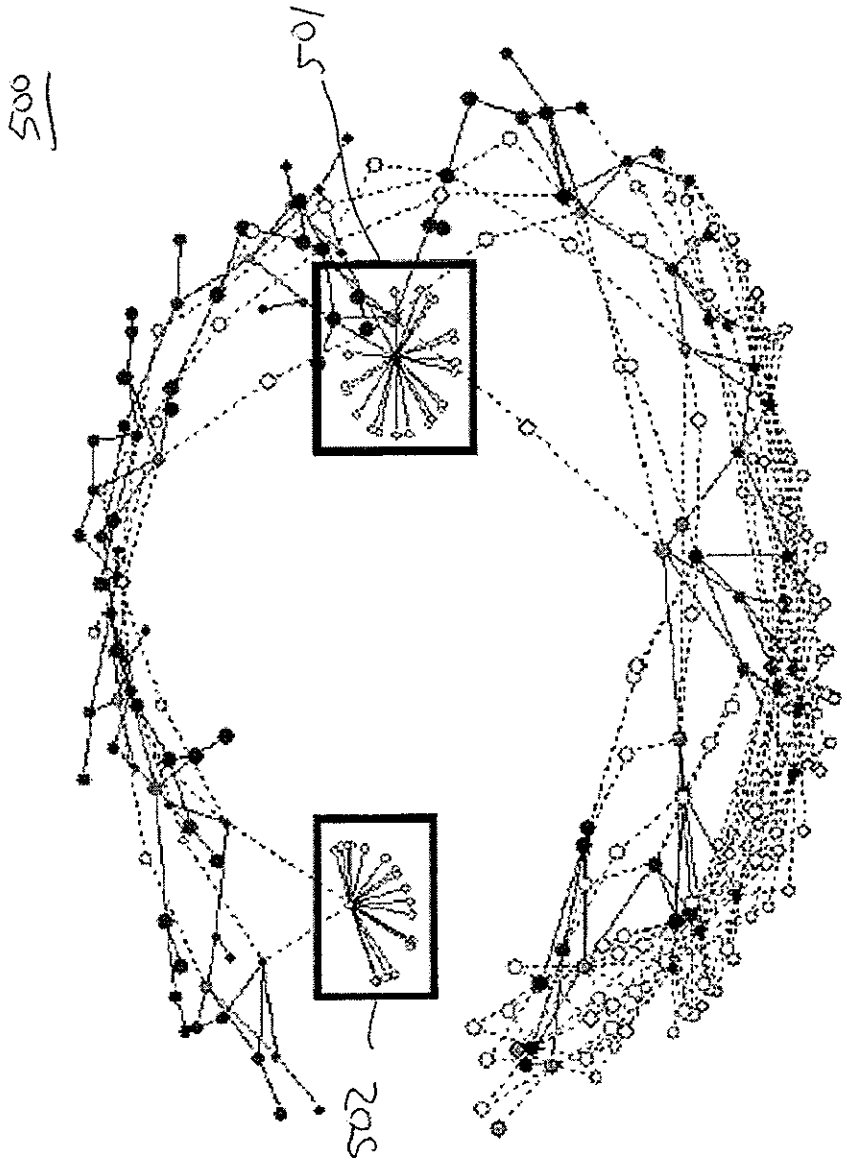


Fig. 5

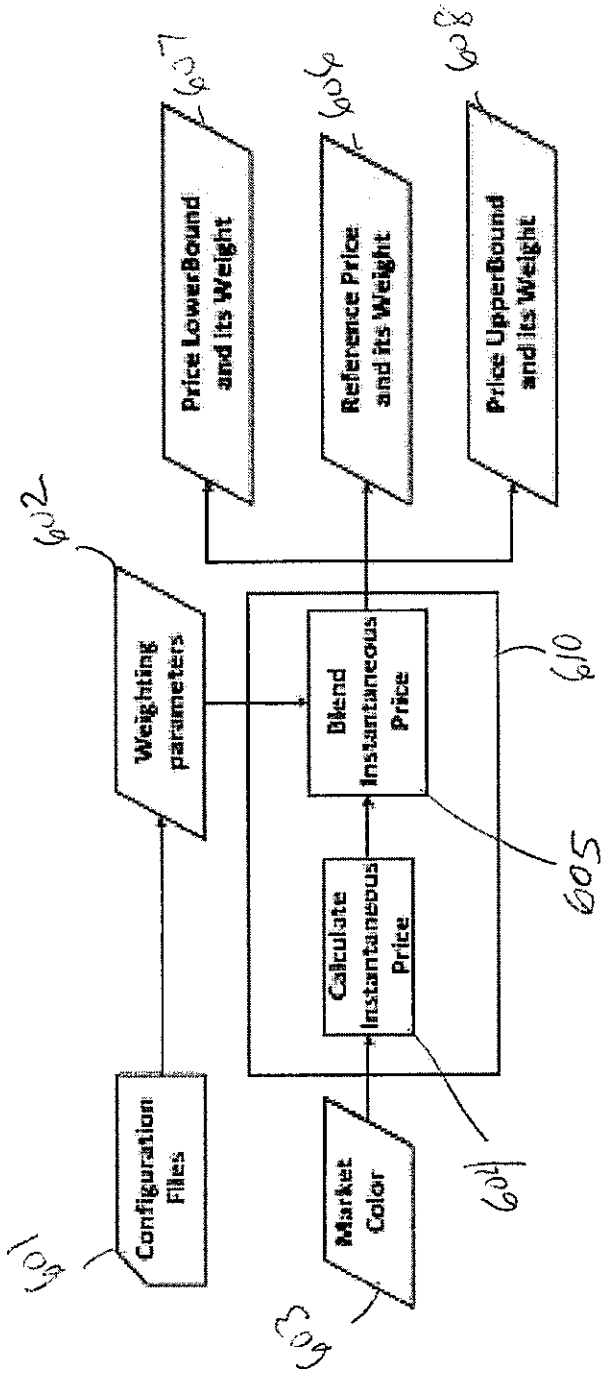

Configuration Files
Market Color
Weighting parameters
Calculate Instantaneous Price
Blend Instantaneous Price
Price LowerBound and its Weight
Reference Price and its Weight
Price UpperBound and its Weight
109
602
604
605
607
608
609
610

Fig. 6

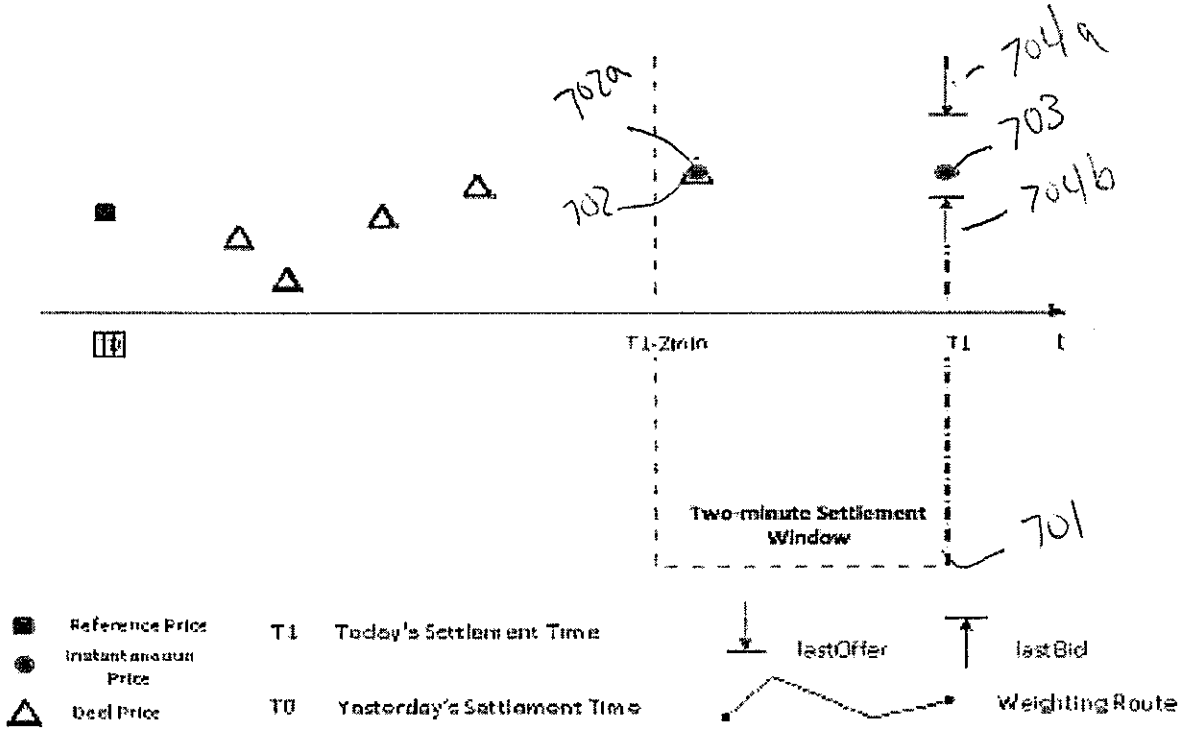

702a
702
704a
703
704b
T1-2min
T1
t
Two-minute Settlement Window
701
Reference Price
Instantaneous Price
Deal Price
T1
Today's Settlement Time
T0
Yesterday's Settlement Time
lastOffer
lastBid
Weighting Route

Fig. 7

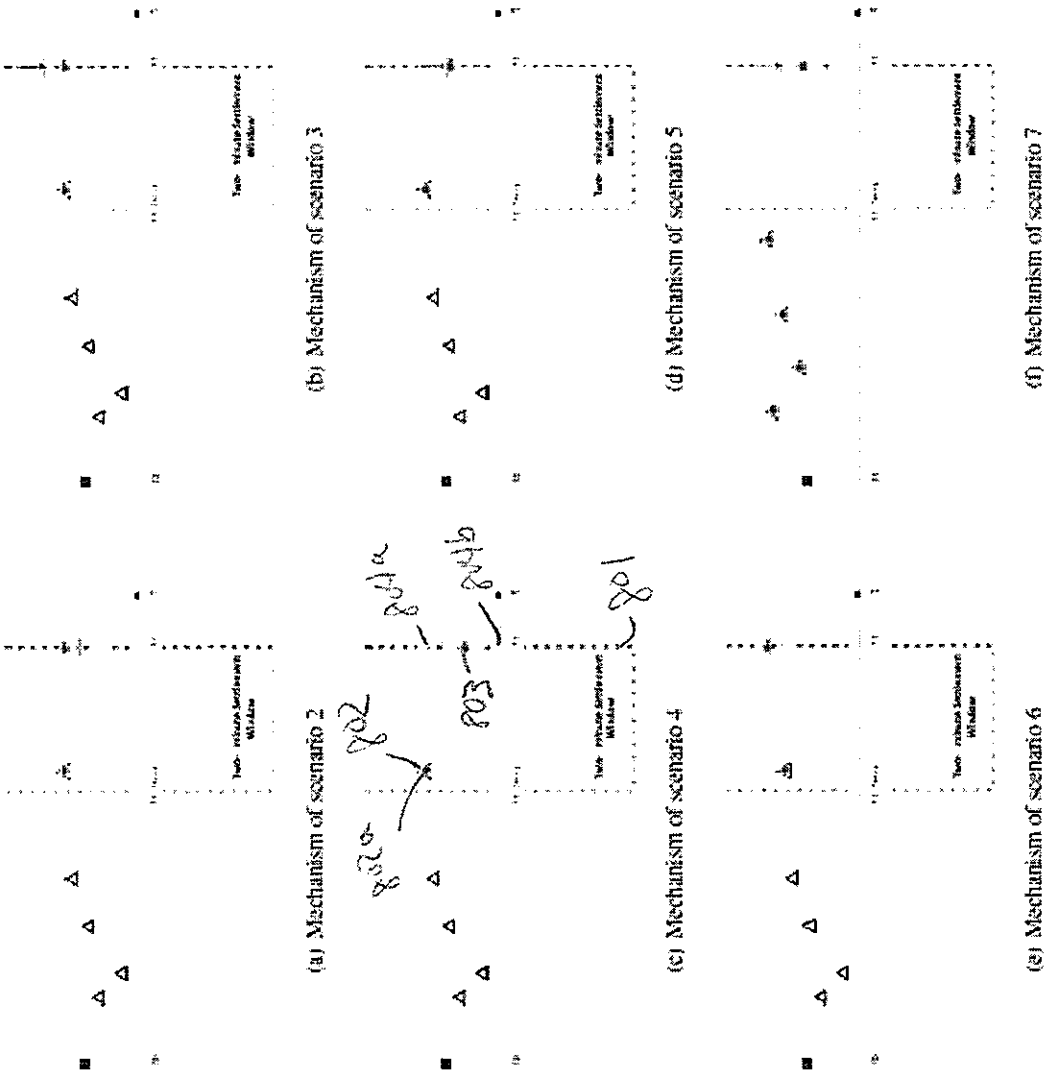
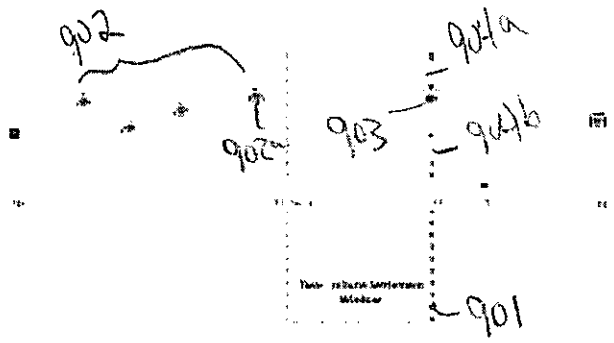
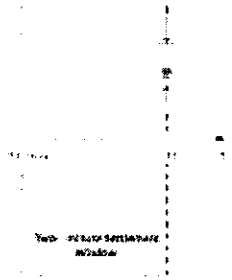

(a) Mechanism of scenario 2
(b) Mechanism of scenario 3
(c) Mechanism of scenario 4
(d) Mechanism of scenario 5
(e) Mechanism of scenario 6
(f) Mechanism of scenario 7

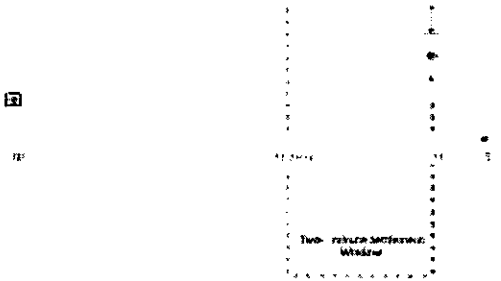
Fig. 8



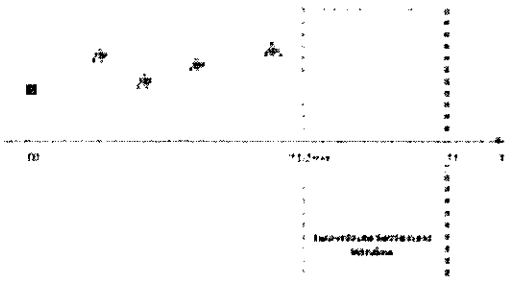
(a) Mechanism of scenario 8



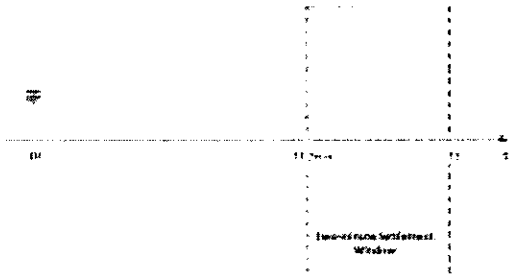
(b) Mechanism of scenario 9



(c) Mechanism of scenario 10



(d) Mechanism of scenario 11



(e) Mechanism of scenario 12

Fig. 9

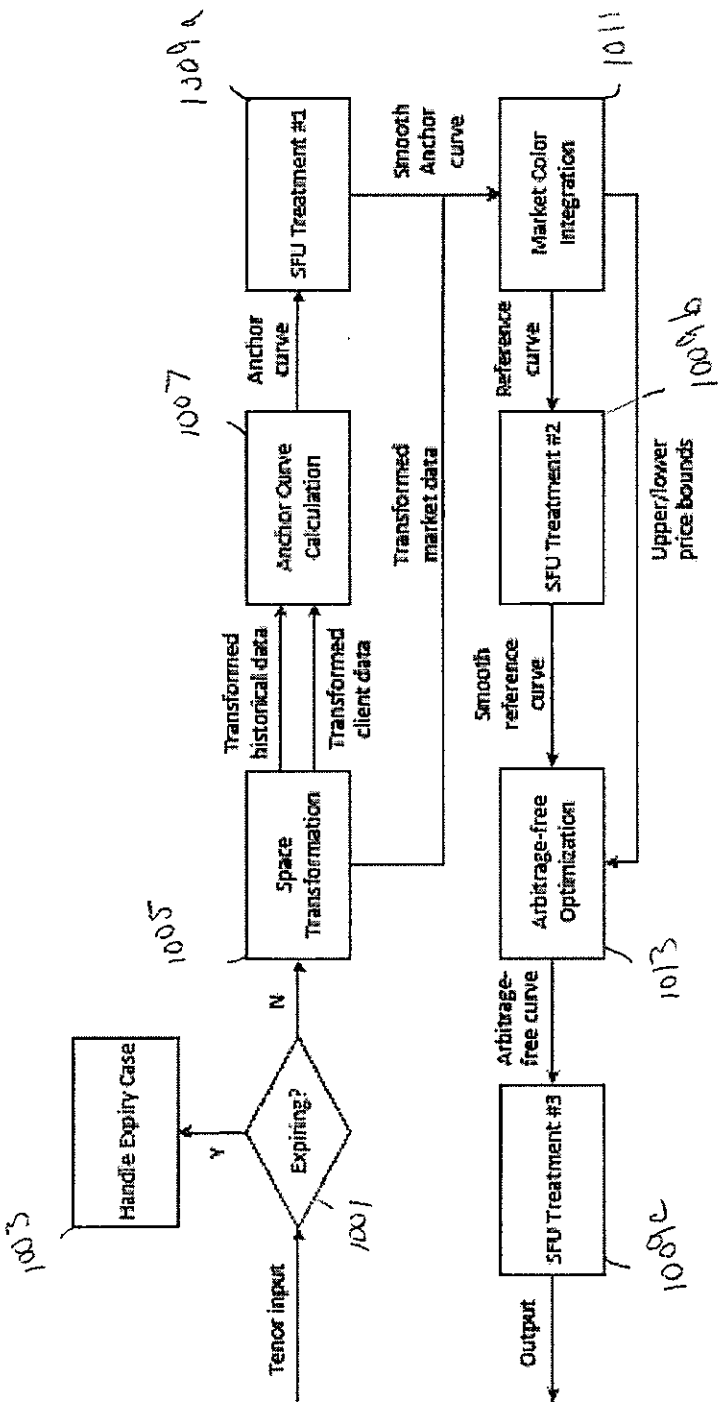

1000
1009a
SFU Treatment #1
Smooth Anchor curve
1011
Market Color Integration
1007
Anchor curve
Anchor Curve Calculation
Transformed market data
Reference curve
1009b
SFU Treatment #2
Upper/lower price bounds
Transformed historical data
Transformed client data
Smooth reference curve
1005
Sparse Transformation
Arbitrage-free Optimization
1013
N
Arbitrage-free curve
1003
Handle Expiry Case
Y
Expiring?
1001
Tenor input
1009c
SFU Treatment #3
Output

Fig. 10

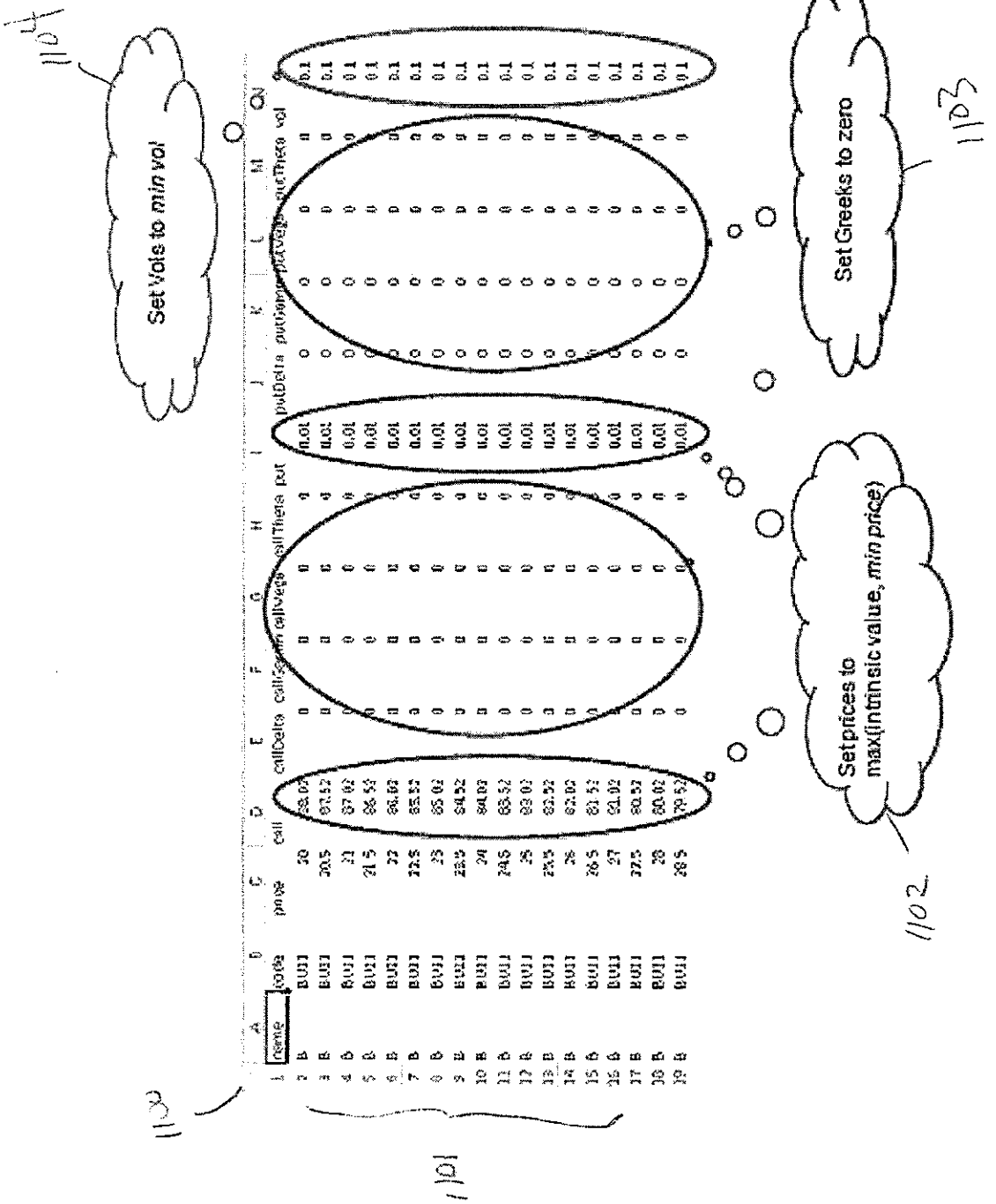

Set Vols to min vol
Set prices to max(intrinsic value, min price)
Set Greeks to zero
1101
1102
1103
1104
1105

Fig. 11

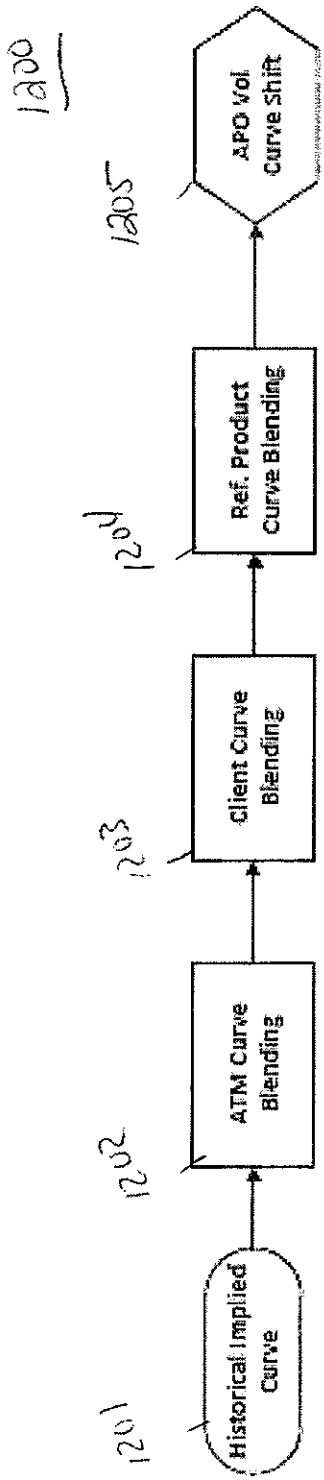

1200
1201
Historical Implied Curve
1202
ATM Curve Blending
1203
Client Curve Blending
1204
Ref. Product Curve Blending
1205
APO Vol Curve Shift

Fig. 12

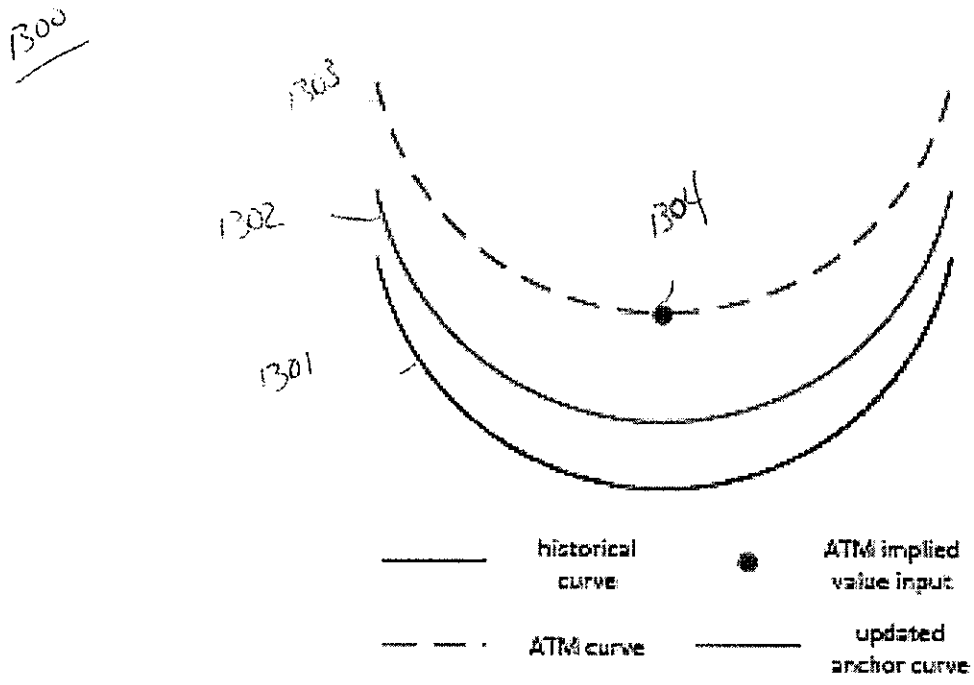

1300
1303
1302
1304
1301
historical curve
ATM implied value input
ATM curve
updated anchor curve

Fig. 13

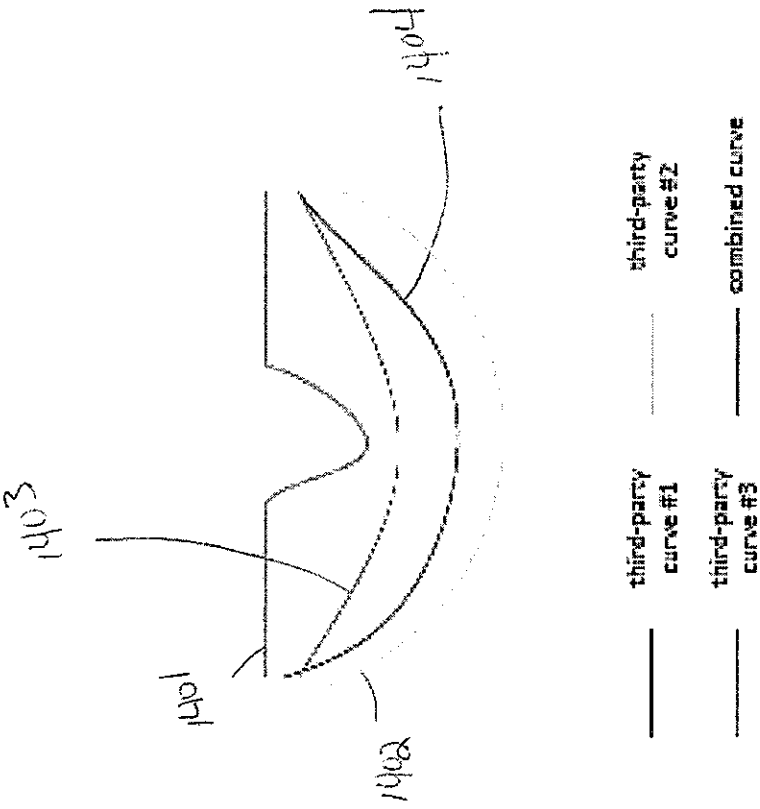

1403
1401
1402
1404
third-party curve #1
third-party curve #2
third-party curve #3
combined curve

Fig. 14

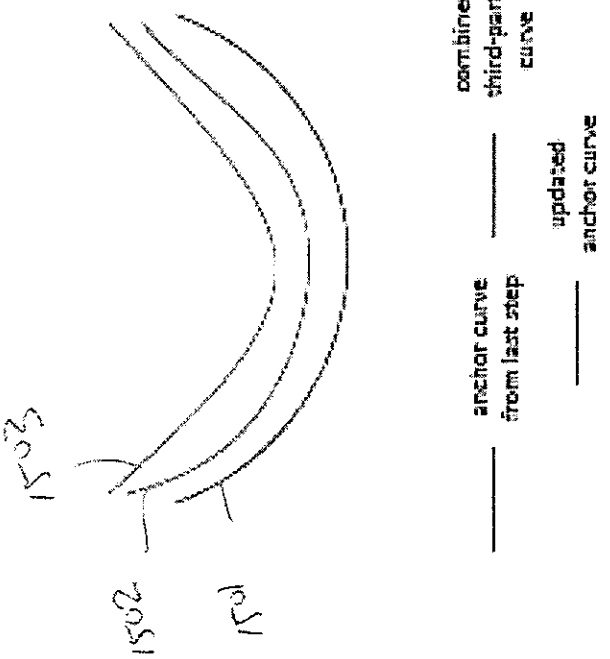

1503
1502
1501
anchor curve from last step
combined third-party curve
updated anchor curve

Fig. 15

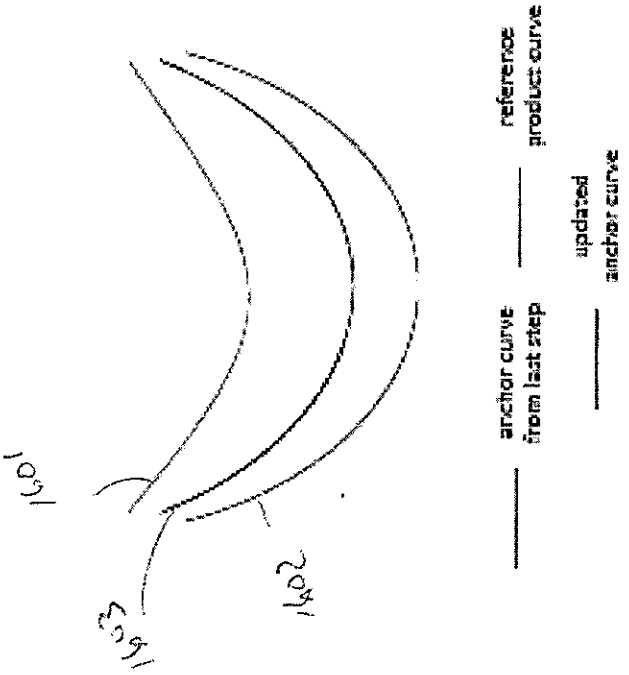

1601
1603
1602
anchor curve from last step
reference product curve
updated anchor curve

Fig. 16

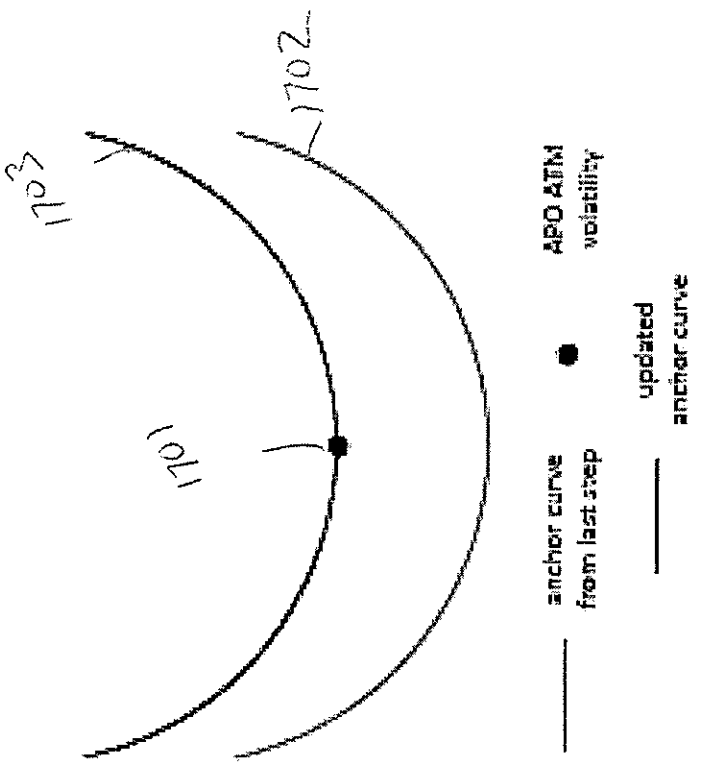
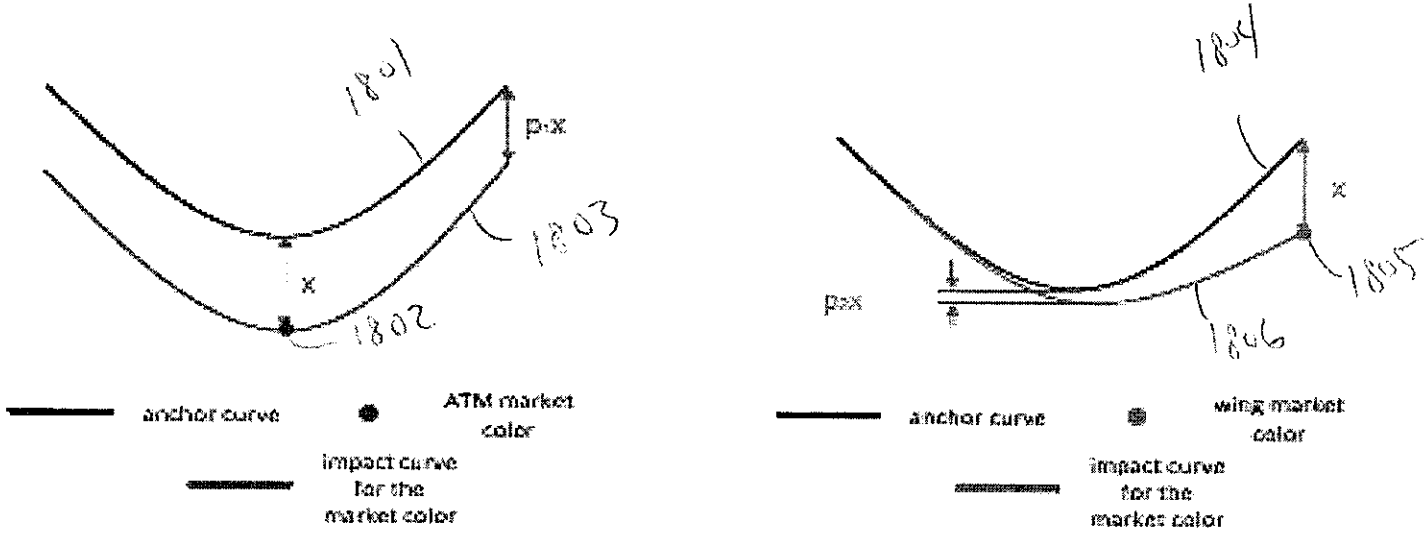

1703
1702
1701
anchor curve from last step
APO ATM volatility
updated anchor curve

Fig. 17



(a) impact of ATM market input

(b) impact of wing market input

Fig. 18

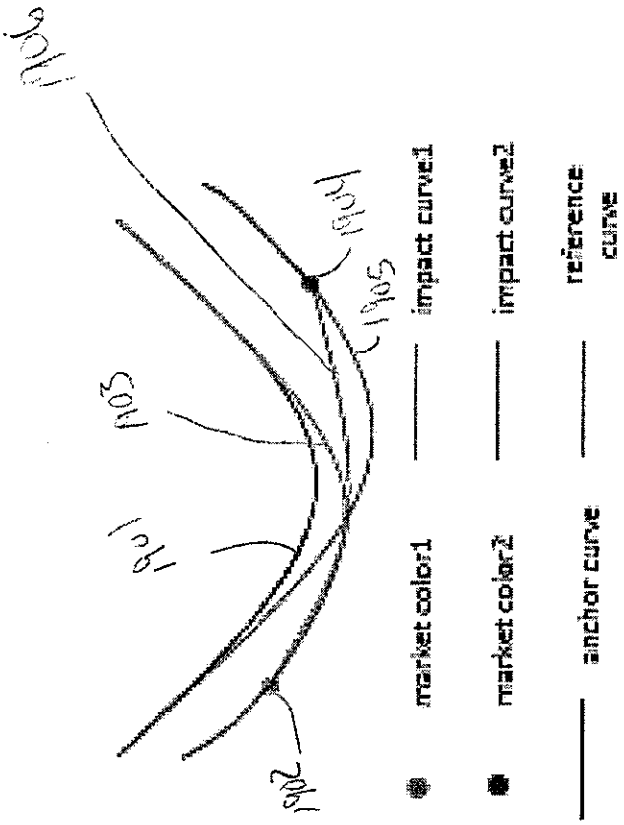

1901
1902
1903
1904
1905
1906
market color1
impact curve1
market color2
impact curve2
anchor curve
reference curve

Fig. 19

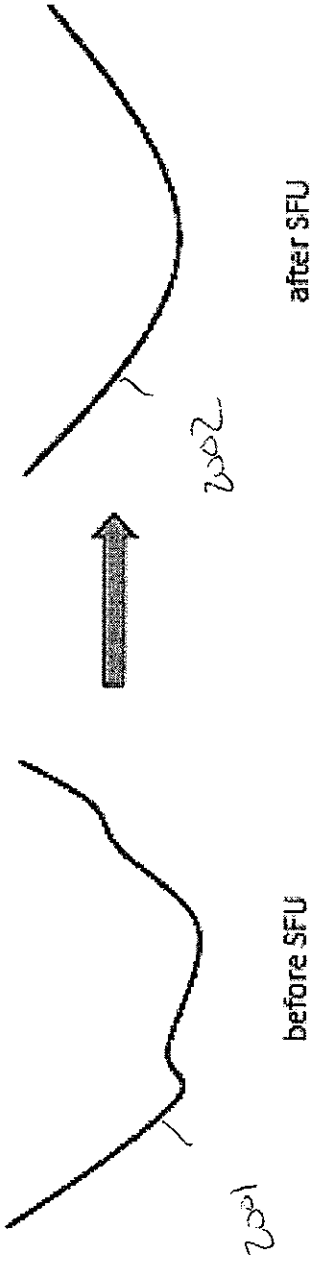


Fig. 20

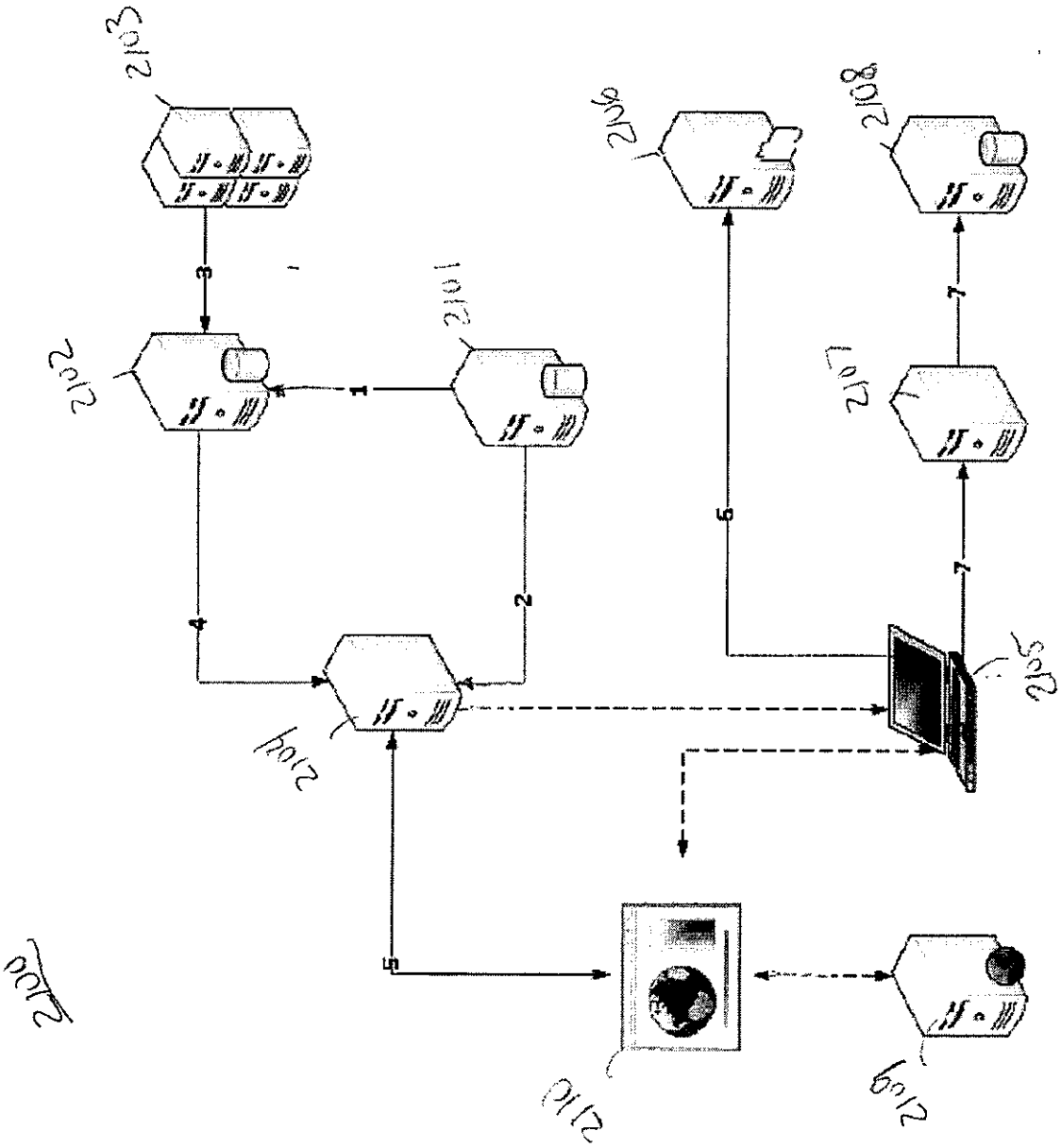

2102
2103
2112
2101
2106
2108
2107
2104
2105
2110
2109
1
2
3
4
5
6
7
7

Fig. 21

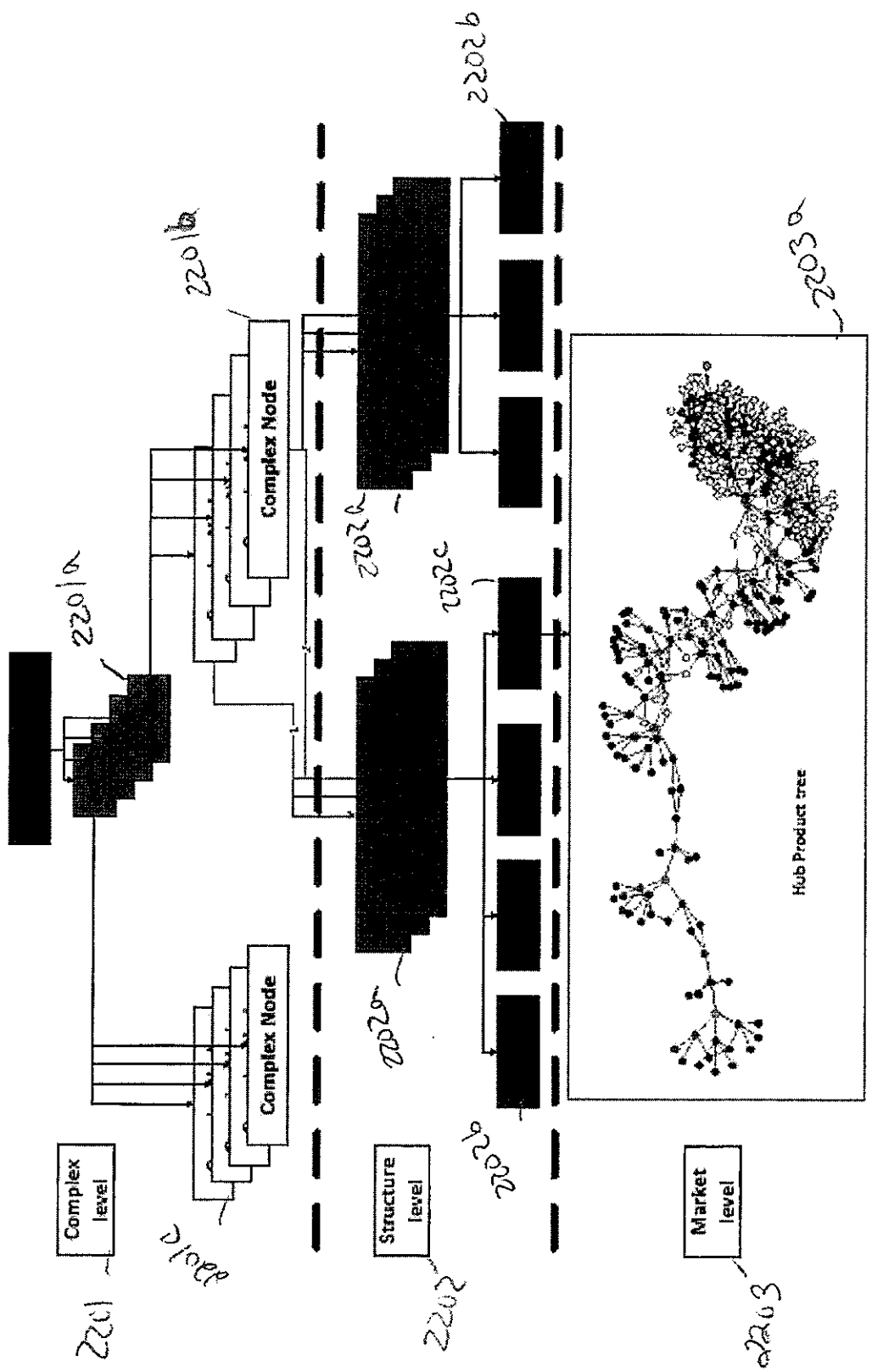

2200
2201
2201a
2201b
2201c
2202
2202a
2202b
2202c
2202d
2203
2203a
Complex level
Structure level
Market level
Complex Node
Complex Node
Hub Product tree

Fig. 22

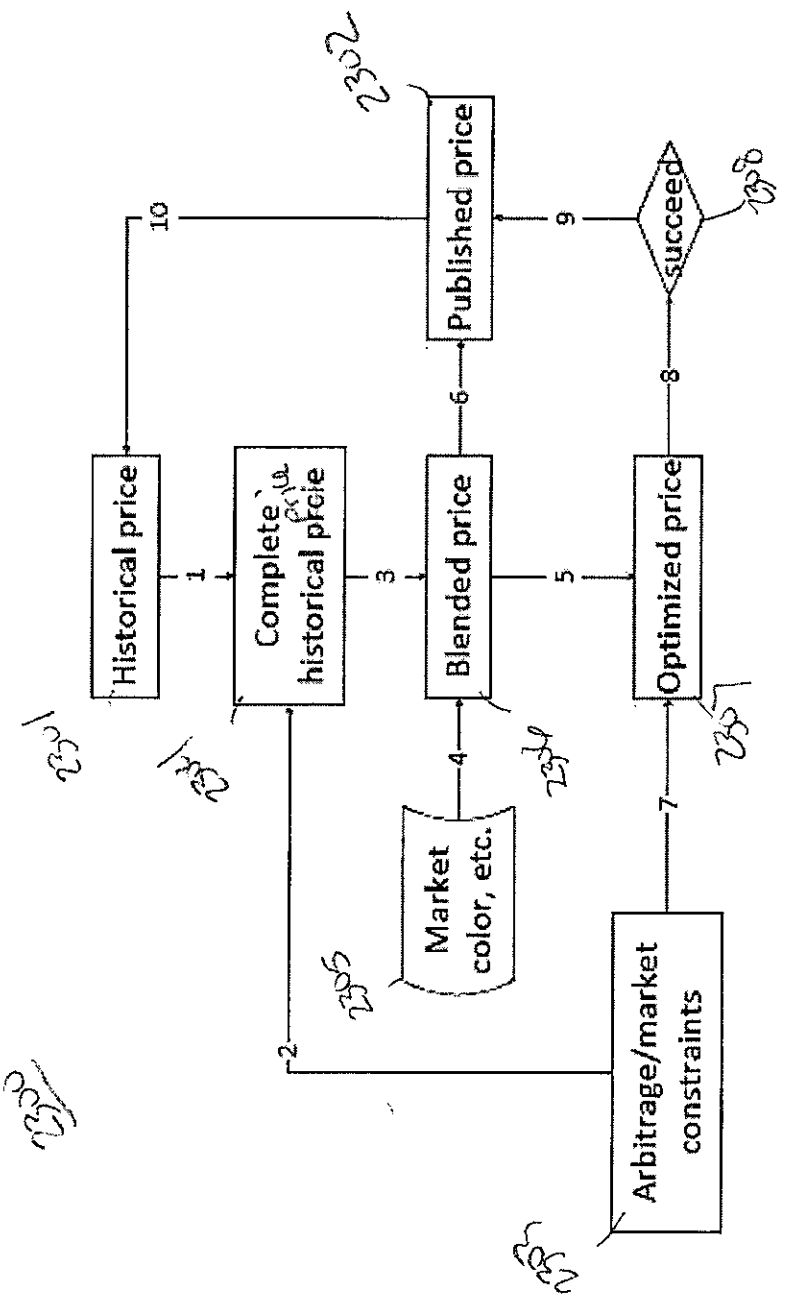

2300
2301
2302
2303
2304
2305
2306
2307
2308
Historical price
Complete historical price
Blended price
Published price
Market color, etc.
Optimized price
Arbitrage/market constraints
succeed
1
2
3
4
5
6
7
8
9
10

Fig. 23